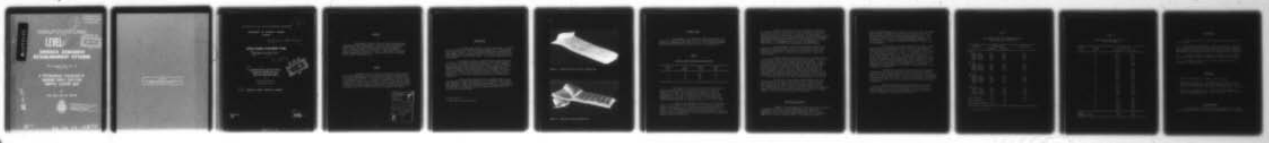
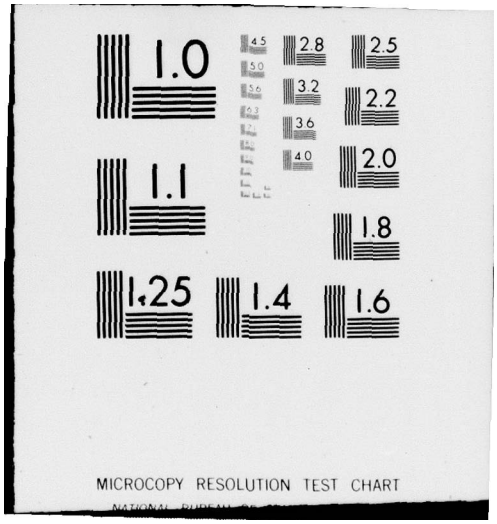
AD-A074 143 DEFENCE RESEARCH ESTABLISHMENT OTTAWA (ONTARIO) F/G 6/7
A PHYSIOLOGICAL EVALUATION OF CANADIAN FORCES SEAT-PACK SURVIVA--ETC(U)
JUN 79 R W NOLAN, S W CATTROLL

UNCLASSIFIED DREO-TN-79-10 NL

| OF |
ADA
074143



END
DATE
FILMED
10-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
MICROCOPY RESOLUTION TEST CHART

RESEARCH AND DEVELOPMENT BRA
DEPARTMENT OF NATIONAL DEFE
CANADA

LEVEL II

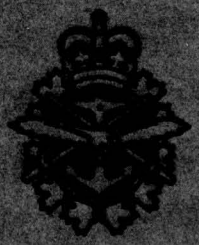
DEFENCE RESEARC
ESTABLISHMENT OTTA

DREO TECHNICAL NOTE NO. 79-10
DREO TN 79-10

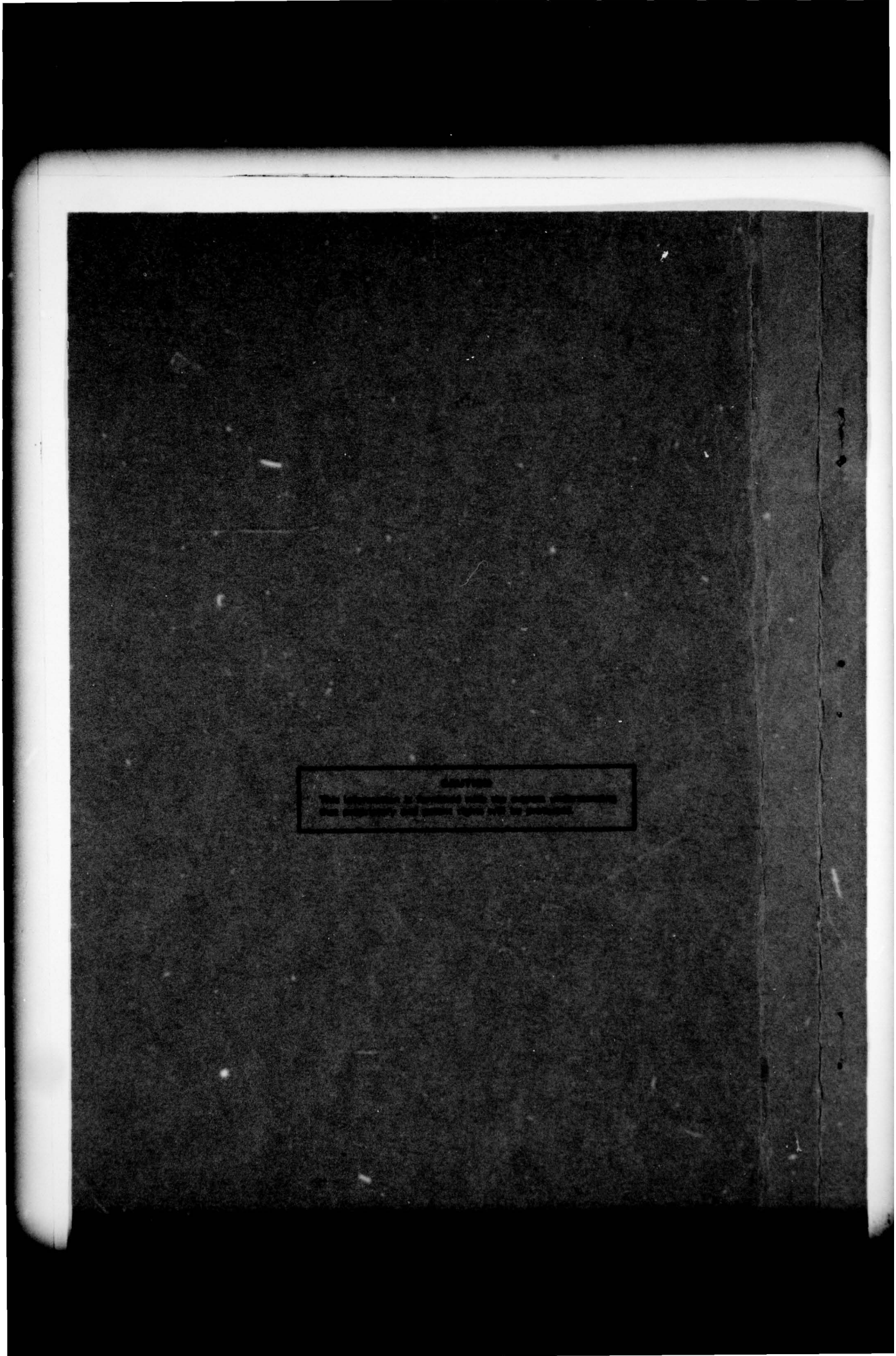
A PHYSIOLOGICAL EVALUATION
CANADIAN FORCES SEAT-PACK
SURVIVAL SLEEPING BAGS

by

R.W. Nolan and S.W. Cottrell



CT NO.



RESEARCH AND DEVELOPMENT BRANCH

DEPARTMENT OF NATIONAL DEFENCE
CANADA

(14) DREO-TN-79-10

DEFENCE RESEARCH ESTABLISHMENT OTTAWA

(9) TECHNICAL NOTE NO. 79-10

(12) 14 p.

(6) A PHYSIOLOGICAL EVALUATION OF CANADIAN FORCES SEAT-PACK SURVIVAL SLEEPING BAGS,

by
R.W. Nolan and S.W. Cattroll
Protective Sciences Division

(10) Richard W. /Nolan Stanley W. /Cattroll

PROJECT NO.
14B00

(11) JUNE 1979
OTTAWA

ABSTRACT

The standard Canadian Forces survival sleeping bag and a prototype survival sleeping bag of different design were evaluated simultaneously using test subjects resting in the cold chamber at -23°C. A series of tests was conducted to compare the thermal protection afforded by each type of bag. No significant differences between sleeping bags were found. Subjects preferred the prctotype bag for ease of entry and exit.

RÉSUMÉ

Le modèle standard de sac de couchage de survie utilisé par les Forces canadiennes et un sac prototype de conception différente ont été évalués simultanément à l'aide de tests effectués en chambre froide à une température de -23°C. Ces essais, effectués dans le but de comparer la protection fournie contre le froid par l'un et l'autre type de sac de couchage, n'ont révelé aucune différence importante entre ces deux modèls, sinon que les militaires appelés à les mettre à l'essai prèfèrent le sac prototype parce qu'il est plus facile de s'y glisser et d'en sortir.

INTRODUCTION

One of the items carried in the survival package on Canadian Forces aircraft is the seat-pack survival sleeping bag.* This sleeping bag, shown in Figure 1, is a down-and-feather-filled, mummy-shaped bag with integral hood for thermal protection of the head. The nylon taffeta outer covering is an olive green colour. This bag has an opening at the top end only.

In a recent incident, injured personnel experienced great difficulty in entering the survival sleeping bag via the top opening. As a result, a prototype sleeping bag filled with a similar quantity of down-and-feather insulant was constructed. This sleeping bag, shown in Figure 2, features a full-length zipper which facilitates entry into the bag and enables it to be opened and used as a blanket. A separate hood is used. The proofed rip-stop nylon covering is international orange in colour, providing increased visibility in search-and-rescue operations.

Four prototype seat-pack survival sleeping bags and four survival bags in current use (referred to as "standard" in this report) were submitted to DREO for physiological evaluation (1). The evaluation was conducted to compare the thermal protection afforded by each type of sleeping bag and to determine if the prototype bag was as good as or better than the standard bag.

---

* NATO Stock No. 8465-21-520-005

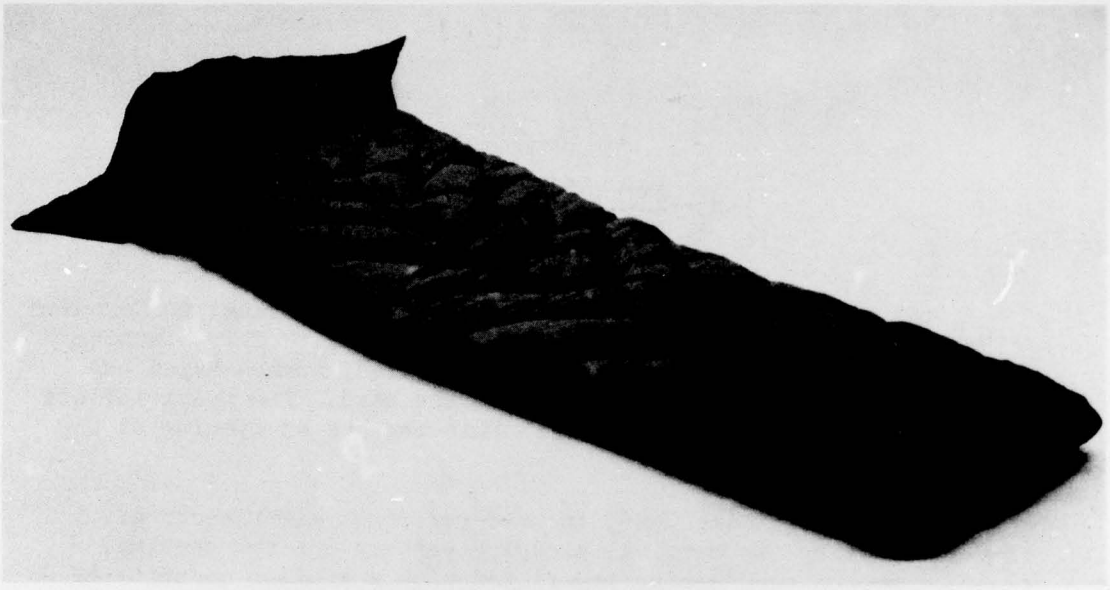


Figure 1. Current Seat-Pack Survival Sleeping Bag.

Figure 2. Prototype Survival Sleeping Bag.

METHOD OF TEST

Four members of the CF/DREO Test Team participated in the evaluation. They were young, male, active military personnel and their physical characteristics are given in Table I. All of the participants had had previous experience in using the CF Arctic sleeping bag.

TABLE I

Physical Characteristics of Test Subjects

Subject No.	Age (years)	Height (cm)	Weight (kg)
1	27	163	59
2	21	185	70
3	20	173	78
4	20	188	90

The comparative evaluation was conducted over a period of several weeks using the four subjects who rested in the DREO cold chamber for four-hour test sessions at a moderately cold ambient temperature of -23°C. Two sleeping bags of each design were tested simultaneously. The type of sleeping bag used by each subject was changed on successive days so that by the end of the evaluation, each of the subjects had slept in each type of bag a total of seven times.

In order to simulate field conditions and to reduce the effect of wind caused by the circulation of air from the refrigeration unit, subjects slept in a CF five-man Arctic tent erected in the cold chamber. The sleeping bags rested on air mattresses placed on the wooden floor of the chamber inside the tent. The only items of clothing worn by the test subjects while in the sleeping bags were CF extreme-cold-weather drawers and undershirt.

Thermal protection afforded by each type of sleeping bag was assessed in terms of differences in rectal temperature (T_R), chest, arm, leg and great-toe temperatures. These were measured using YSI thermistor probes and were recorded automatically at twenty-minute intervals during each four-hour test session using a Digitec Model 1581 Datalogger. Mean weighted skin temperature MWST = 0.5 chest temperature + 0.14 arm temperature + 0.36 leg temperature) and total body temperature (T_{TB} = 0.67 T_R + 0.33 MWST) were calculated at selected intervals.

The total weight of each sleeping bag was measured at the beginning and end of each test session and the change in weight due to absorption of perspiration was calculated. After every session each sleeping bag was dried in a commercial clothes dryer for a period of twenty minutes.

A method described by Haley and King (2) and used previously by the present authors (3) was used to determine the number of hours of sleep obtained by each of the subjects during test sessions. A hand button was placed inside each sleeping bag and subjects were instructed to press the button in response to a faint alarm which sounded automatically inside the tent every fifteen minutes. The volume of the alarm was adjusted so that it did not awaken sleeping personnel but could be heard by those not sleeping. Subjects were considered to be asleep during any fifteen minute period in which they did not press the hand button. Pressing the button caused a deflection of one of the pens of a four-channel chart recorder which operated throughout each session.

For each test session the following procedure was used. Subjects reported for duty at approximately 08:45, thermistor probes were fitted and the clothing to be worn during the test was donned. Each sleeping bag was then weighed and the subjects entered the cold room at approximately 09:15. Technical personnel connected the temperature probes to the recording equipment and lights were turned out. Subjects remained in the cold room for a period of four hours.

RESULTS AND DISCUSSION

A summary of the mean results obtained during this evaluation is presented in Table II. Rectal temperatures (T_R), total body temperatures (T_{TB}), mean weighted skin temperatures (MWST) and toe temperatures (T_{toe}) of the test subjects after resting in the sleeping bags for 1, 2, 3 and 4 hours are given. In addition, the number of

hours sleep obtained during the four-hour test period, the total weight and the change in weight due to moisture pick-up are given. Each of the test subjects used each type of sleeping bag seven times. Thus, each entry in columns 2 and 3 of Table II represents the mean of 28 different results. Table III, "Mean Weighted Skin Temperatures (°C) After 4 Hours", is included to illustrate the nature of a typical set of observations.

The two sets of raw data (standard and prototype sleeping bags) for each of the parameters listed in Table II were analyzed statistically using the Student t-test. The calculated t statistic in each case is given in column 4 of Table II. The tabulated t statistic for this particular analysis (P = 0.005, 27 degrees of freedom) is given at the bottom of the Table. A significant difference was found in only one instance - the prototype bag gained a significantly greater amount of moisture than the standard bag. This is probably due to the fact that, while not mathematically significantly different, subjects tended to be slightly warmer in the prototype bag. The physical significance of the difference in the amount of moisture gained (~10g) is probably not important.

Although the evaluations were conducted during the day, subjects were able to fall asleep with relative ease and, in general, remained asleep for approximately 3.5 hours (of a four-hour test session.) None of the subjects felt uncomfortably cool even though toe temperatures approached 20°C after four hours. It should be noted that in a survival situation, personnel would normally remain fully clothed when using the sleeping bag.

Subjects preferred the prototype sleeping bag for ease of entry and exit but often experienced difficulty with the zipper becoming caught in the canvas lining material. On one occasion, it became necessary to return a bag to DCGEM for repair. The closure should be redesigned to overcome this difficulty.

TABLE II

Physiological Data from Sleeping Bag Tests
Mean Results and t Statistics

Parameter	Sleeping Bag		t Statistic*
	Standard	Prototype	
T_R (°C)			
after 1 hour	36.7	36.7	0.93
after 2 hours	36.4	36.5	0.44
after 3 hours	36.4	36.4	0.33
after 4 hours	36.3	36.3	0.13
T_{TB} (°C)			
after 1 hour	35.9	35.9	0.18
after 2 hours	35.7	35.8	0.53
after 3 hours	35.6	35.7	1.27
after 4 hours	35.5	35.6	1.49
MWST (°C)			
after 1 hour	34.2	34.2	0.24
after 2 hours	34.2	34.3	0.56
after 3 hours	34.0	34.3	1.03
after 4 hours	33.6	34.1	1.72
T_{toe} (°C)			
after 1 hour	27.9	28.7	0.45
after 2 hours	25.0	25.4	0.15
after 3 hours	22.6	23.4	0.58
after 4 hours	20.3	21.5	0.57
Hours of sleep	3.51	3.47	0.58
Moisture gain (g)	61	71	3.40
Total weight (dry)(kg)	2.98	3.01	

* $t(0.005, 27) = 2.77$

TABLE III

Mean Weighted Skin Temperature (°C)
After Four Hours

Subject No.	Session No.	Sleeping Bag Standard	Sleeping Bag Prototype
	1	33.1	34.0
	2	34.4	34.2
	3	34.7	34.5
1	4	33.8	33.7
	5	35.4	35.1
	6	34.2	34.3
	7	34.3	34.8
	1	32.3	35.8
	2	33.4	33.8
	3	35.1	34.6
2	4	33.6	34.9
	5	33.8	35.2
	6	33.9	35.3
	7	34.6	35.4
	1	29.1	34.1
	2	35.3	32.3
	3	32.7	34.3
3	4	32.8	35.0
	5	33.3	33.2
	6	33.4	33.8
	7	32.8	33.8
	1	33.4	32.5
	2	33.3	33.7
	3	33.5	32.7
4	4	33.5	33.9
	5	33.4	33.3
	6	33.1	32.9
	7	33.2	32.6
Mean		33.6	34.1
Standard Deviation		1.17	0.95

CONCLUSIONS

Under the conditions of this evaluation the results indicate the following:

1. At an ambient temperature of -23°C, no significant differences in the thermal protection afforded by either type of survival sleeping bag were found when mean rectal temperatures, mean total body temperatures, mean weighted skin temperatures or mean toe temperatures were compared.

2. Subjects preferred the prototype seat-pack survival sleeping bag over the standard survival sleeping bag for ease of entry and exit.

3. The zipper closure on the prototype sleeping bag should be redesigned to prevent snagging.

REFERENCES

1. DCGEM, letter 10055-69-024 (DCGEM), dated 10 May 1978.

2. Haley, R.L. and King, D.A. "Development Test II (Service Phase) of Cold Weather Sleeping Gear Under Arctic Winter Conditions. Final Report." U.S. Army Arctic Test Center, APO Seattle, 98733, 31 May 1973.

3. Nolan, R.W. and Cattroll, S.W. "A Physiological Assessment of Arctic Sleeping Bags Under Cold Weather Conditions." DREO Technical Note No. 75-22, November 1975.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the cooperation of the members of the CF/DREO Test Team who acted as test subjects during this evaluation.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATING ACTIVITY Defence Research Establishment Ottawa National Defence Headquarters Ottawa, Canaca, K1A 0Z4	2a. DOCUMENT SECURITY CLASSIFICATION Unclassified 2b. GROUP II

3. DOCUMENT TITLE

A Physiological Evaluation of Canadian Forces Seat-Pack Survival Sleeping Bags (U)

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Technical Note

5. AUTHOR(S) (Last name, first name, middle initial)

Nolan, Richard W. and Cattroll, Stanley, W.

6. DOCUMENT DATE May 1979	7a. TOTAL NO. OF PAGES 8	7b. NO. OF REFS 3
8a. PROJECT OR GRANT NO. 14B00	9a. ORIGINATOR'S DOCUMENT NUMBER(S) DREO Tech. Note No. 79-10	
8b. CONTRACT NO.	9b. OTHER DOCUMENT NO.(S) (Any other numbers that may be assigned this document)	

10. DISTRIBUTION STATEMENT

Distribution Unlimited

11. SUPPLEMENTARY NOTES	12. SPONSORING ACTIVITY

13. ABSTRACT

(U)

The standard Canadian Forces survival sleeping bag and a prototype survival sleeping bag of different design were evaluated simultaneously using test subjects resting in the cold chamber at -23°C. A series of tests was conducted to compare the thermal protection afforded by each type of bag. No significant differences between sleeping bags were found. Subjects preferred the prototype bag for ease of entry and exit.

DSIS

77-065

UNCLASSIFIED

Security Classification

KEY WORDS

Bag, sleeping
Survival
Arctic clothing
Cold weather tests
Thermal insulation
Physiological evaluation

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the organization issuing the document.

2a. *DOCUMENT SECURITY CLASSIFICATION: Enter the overall* security classification of the document including special warning terms whenever applicable.

2b. GROUP: *Enter security reclassification group number.* The three groups are defined in Appendix 'M' of the DRB Security Regulations.

3. DOCUMENT TITLE: Enter the complete document title in all *capital letters.* Titles in all cases should be unclassified. If a sufficiently descriptive title cannot be selected without classification, show title classification with the usual one-capital-letter abbreviation in parentheses immediately following the title.

4. DESCRIPTIVE NOTES: Enter the category of document, e.g. technical report, technical note or technical letter. If appropriate, enter the type of document, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the document. Enter last name, first name, middle initial. If military, show rank. The name of the principal author is an absolute minimum requirement.

6. DOCUMENT DATE: Enter the date (month, year) of *Establishment approval for publication* of the document.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the document.

8a. PROJECT OR GRANT NUMBER: If appropriate, enter the applicable research and development project or grant number under which the document was written.

8b. CONTRACT NUMBER: If appropriate, enter the applicable number under which the document was written.

9a. ORIGINATOR'S DOCUMENT NUMBER(S): Enter the official document number by which the document will be identified and controlled by the originating activity. This number must be unique to this document.

9b. OTHER DOCUMENT NUMBER(S): If the document has been assigned any other document numbers (either by the originator or by the sponsor), also enter this number(s).

10. DISTRIBUTION STATEMENT: Enter any limitations on further dissemination of the document, other than those imposed by security classification, using standard statements such as:

    (1) "Qualified requesters may obtain copies of this document from their defence documentation center."

    (2) "Announcement and dissemination of this document is not authorized without prior approval from originating activity."

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document, even though it may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall end with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (TS), (S), (C), (R), or (U).

    The length of the abstract should be limited to 20 single-spaced standard typewritten lines; 7½ inches long.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a document and could be helpful in cataloging the document. Key words should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context.